to place the same in condition for allowance. Reconsideration of the application and allowance in its amended form are requested based on the following remarks.

Applicants retain the right to pursue broader claims under U.S.C. § 120.

Applicants have provided a unique solution with respect to A FLAT PANEL LIQUID-CRYSTAL DISPLAY SUCH AS FOR A LAPTOP.

Applicants' solution is claimed in a manner that satisfies the requirements of 35 U.S.C. §103.

Specifically, Claims 14-16,18-19, 21-33 have been canceled and Claims 34-51 are newly presented herein. Care has been taken to avoid the introduction of new matter. All of the changes made in this Amendment are without prejudice, so that the matter deleted maybe reintroduced as necessary for prosecution of the application.

Please note that for all of the arguments presented herein, the symbol "%" when used in reference to the composition of glass refers to the amount of a particular component in percent by weight based on oxide.

1. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of Narita et al.

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Narita et al. (US 6,468,933).

1a. Rejection Of Examined Claim 20 In View of Narita et al.

The Examiner stated:

> "Narita et al. teach an alkali-free glass consisting of 40-70 wt% SiO_2, 5-20 wt% B_2O_3, 6-25 wt% Al_2O_3, 0-10 wt% MgO, 0-15 wt% CaO, 0-10 wt% SrO, 0-30 wt% BaO, 0-10 wt% ZnO, 0.05-2 wt% SnO_2, and 0.005-2 wt% Cl_2. See abstract of Narita et al. Narita et al. teach that glass can be used as a substrate for

display technologies. See column 1, lines 7-10. Narita et al. teach that it is preferable not to use Sb_2O_3 and As_2O_3 as fining agents due to toxicity. See column 3, lines 46-47. Narita et al. teach that the glass is free from bubbles that result in display defects. See column 1, lines 49-52. The reference teaches that the glass can be formed by various methods including the downdraw process and the float process. See column 4, lines 11-14.

Narita et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Narita et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Narita et al. because overlapping ranges have been held to establish prima facie obviousness.

One of ordinary skill in the art would expect that glasses with overlapping compositional ranges would have overlapping ranges of properties as recited in claims 17-21, 28, and 29."

1b. Discussion Of Rejection Of Examined Claim 20 In View Of Narita et al.

With reference to the Abstract, the cited Narita et al. reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO_2,
5-20 wt% B_2O_3,
6-25 wt%Al_2O_3,
0-10 wt% MgO,
0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,
0-10 wt% ZnO,
0.05-2 wt% SnO_2, and

0.005-2 wt% Cl_2." (emphasis added)

It is submitted that the Narita et al. reference discloses very large ranges for eight of the components of the borosilicate glass. Narita generally discusses extremely broad ranges of components that either encompass or overlap the ranges in Claim 20. In the abstract of Narita, the broad ranges are set forth as follows:

> An alkali-free glass essentially consists of, by weight percent, 40-70% SiO_2, 6-25% Al_2O_3, 5-20% B_2O_3, 0-10% MgO, 0-15% CaO, 0-30% BaO, 0-10% SrO, 0-10% ZnO, 0.05-2% SnO_2, and 0.005-1% Cl_2, and substantially contains no alkali metal oxide.

It is respectfully submitted that these broad ranges do not provide "sufficient specificity" as required by MPEP 2131.03. MPEP 2131.03 states, in part:

> When the prior art discloses a range which touches, overlaps or is within the claimed range, but no specific examples falling within the claimed range are disclosed, a case by case determination must be made as to anticipation. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." What constitutes a "sufficient specificity" is fact dependent. **If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims.** The unexpected results may also render the claims unobvious. The question of "sufficient specificity" is similar to that of "clearly envisaging" a species from a generic teaching. (emphasis added)

With reference to the above bolded portion of MPEP 2131.03, please note that, in the present application, independent Claims 17 and 20

each set forth relatively narrow ranges in comparison to the broad ranges disclosed in Narita.

In addition, the claimed ranges of the present invention have been found to produce "unexpected results." In the present invention, the composition produces a glass having a very high glass transition temperature, T_g, greater than 700°C. As is known in the art, when the transition temperature is increased, a person of skill in the art would expect a corresponding and substantial increase in the temperature at which workability is reached and the temperature at which melting is achieved. However, the claimed composition produced a glass where the working points and melting points did not increase as a person of skill in the art would expect. This concept is discussed in much greater depth below.

Therefore, since the "claims are directed to a narrow range, the reference teaches a broad range and there is evidence of unexpected results within the claimed narrow range...it may be reasonable to conclude that the narrow range is not disclosed with 'sufficient specificity' to constitute an anticipation of the claims," as stated in MPEP 2131.03.

1c. Discussion of Probabilities of Selecting Ranges of Claim 20 From Broad Ranges of Narita Reference

It is also believed that the Narita reference is insufficiently specific because of the size of the broad ranges disclosed in comparison to the relatively narrow ranges recited in the independent claims of the present invention. These broad ranges are not believed to permit a person of ordinary skill in the art to "clearly envisage" the claimed invention. In this regard, Applicant wishes to discuss herein

below what is understood by the Applicant to be the probability of a chance selection of **all** of the preferred ranges as claimed in Claim 20 using the broad ranges disclosed in Narita as a basis.

1c. (A) General Hypothetical Example of Probabilities

However, before Narita is discussed in detail, Applicant wishes to present a hypothetical example to evidence the method employed to calculate the probability of selection of the preferred ranges. In this very simple, hypothetical example, there are two components, labeled X and Y. A person is made aware of the desirability of combining Components X and Y, which components can be combined using different quantities of each component. Unfortunately, the person is not aware of what particular quantity of Component X is desirable to combine with a particular quantity of Component Y. However, the person is made aware that the preferred quantity of Component X is one of two possible quantities, specifically, Quantities A and B, and that the preferred quantity of Component Y is one of four possible quantities, specifically, Quantities C, D, E, and F. The person must then choose only one of the quantities of Component X to combine with only one of the quantities of Component Y in the hope of achieving the desired combination, which in this example is Combination BD (the combination of Quantities B and D). Box A shows the components, quantities, and all possible combinations thereof.

BOX A

	A		B	
Component X	50%		50%	
	C	D	E	F
Component Y	25%	25%	25%	25%
All Possible Combinations	AC, AD, AE, AF, BC, BD, BE, BF			

In order to find the preferred Combination BD, in this example it is assumed that the person must choose first from the available quantities of Component X, that is, between Quantities A and B. Once the person chooses either A or B, he then must choose from the available quantities of Component Y, that is, between Quantities C, D, E, and F, to create a combination. However, as shown in Box A, there are eight possible combinations (AC, AD, AE, AF, BC, BD, BE, BF) of Components X and Y, only one of which combinations, Combination BD, is correct. Therefore, the person has a one in eight chance of picking the preferred quantities to create the preferred combination.

Please note that the chances of selecting **only** the preferred quantity of Component X in the above example are very good. Since there are only two possible quantities to choose from, the person has a one in two, or 50%, chance of selecting the preferred Quantity B. Further, the chances of selecting **only** the preferred quantity of Component Y, though less than Component X, are also fairly good. Since there are only four possible quantities to choose from, the

person has a one in four, or 25%, chance of selecting the preferred Quantity D. However, the chances of selecting **both** of the preferred quantities, and thus the preferred Combination BD, **at the same time** is one in eight, or 12.5%. It is therefore evident that increasing the number of components to be used in a combination, as well as increasing the number of possible quantities of the components, substantially **decreases** the chances that a specific combination could be selected by chance from such numerous possibilities.

1c. (B) Specific Example of Probabilities Using Claim 20 and Narita Reference

This conclusion is evidenced dramatically when examining the teaching of Narita with respect to Claim 20 of the present application, in which example the odds of selecting all of the preferred ranges of Claim 20 from the ranges disclosed in Narita is extremely low. For example, in Narita the content of BaO is within the range of 0 to 30%. In Claim 20, the content of BaO is within the range of greater than 5 to 8.5%, which means that the BaO content is a range that is approximately 3.5%. For a person using Narita as a basis for producing a glass having a BaO content in the range of greater than 5 to 8.5% as disclosed in Claim 20, he would have to pick a range that encompasses 3.5%, such as, for example, 0-3.5% or 7-10.5%, from the overall range of 0-30%.

Please note, however, that there is a tremendous number of possible ranges of 3.5% in a 0-30% range. Therefore, the chance or probability that the person, using the 0-30% BaO range in Narita as a basis, would pick the approximately 5 to 8.5% BaO range as disclosed in Claim 20 would be very low. To further explain by way of another

conservative, hypothetical example, similar to the one above, it could be assumed that Narita shows approximately eight 3.5% ranges, starting with zero and increasing in 3.5% increments, for example, as follows: 0-3.5%, 3.5-7%, 7-10.5%, 10.5-14%, 14-17.5%, 17.5-21%, 21-24.5%, and 24.5-28%. Out of these eight possibilities, it could be assumed that only one is the preferred range for BaO. Therefore, in this example, the person using Narita as a basis would have approximately a one in eight, or 12.5%, chance of selecting the preferred range. As stated above, this is a very conservative example, and it is presented for purposes of argument. The actual chances of selecting the preferred range could be substantially lower since there are a great number of possible 3.5% ranges that could be found in a 0-30% range. It is therefore respectfully submitted that Narita is not sufficiently specific in its disclosed ranges to teach or suggest the invention as claimed in Claim 20 based **solely** on the slight chance of picking the correct range of BaO.

Assuming for the sake of argument that a person were to essentially "beat the odds" and select the preferred 3.5% range for BaO, he still would have to overcome the odds of picking each and every preferred range for all of the other components. Further, with the addition of each component into the selection process, the odds of selecting **some or all** of the components in their preferred ranges, even in the conservative example presented herein, are extremely low. For example, SrO in Narita is found within a range of 0-10%, whereas the SrO range in Claim 20 is 0.1-1.5%. Using the same method used above for BaO, it could be assumed that Narita shows approximately seven 1.4% ranges, starting with zero and increasing in 1.4%

increments, for example, as follows: 0-1.4%, 1.4-2.8%, 2.8-4.2%, 4.2-6%, 6-7.4%, 7.4-8.8%, and 8.6-10%. Out of these seven possibilities, it could be assumed that only one is the preferred range for SrO. Therefore, in this example, the person using Narita as a basis would have approximately a one in seven, or 14.3%, chance of selecting the preferred range of SrO.

Assuming, hypothetically, that the person must choose one of eight possible ranges for BaO, and then has to select one of seven possible ranges for SrO, the odds of picking **both** preferred ranges **at the same time** increases substantially. To further explain, for every one of the eight possible ranges for BaO, there are seven possible ranges of SrO that could be combined with it. Therefore, there are **56** possible combinations (8 BaO times 7 SrO) of the possible ranges of BaO and SrO. Since only **one** of the **56** possible combinations is the preferred combination of ranges, the person has a very slight, one in 56, or approximately 2%, chance of selecting the right combination of ranges.

As one can imagine, with each additional component, the chances of choosing **all** of the preferred ranges increases exponentially. Based on the above method of calculation, even in the very conservative example presented herein below, the odds of choosing **all** of the preferred ranges as set forth in Claim 20, using Narita as a guide, are approximately **one in 3,134,796** (see Table 1). It is respectfully submitted that such odds would be extremely difficult, if not impossible, to overcome.

1c. (C) Additional Example of Probabilities Using Claim 20 and Narita Reference and Including Intermediate Ranges

Again, it should be emphasized that the above examples are very conservative. In the above examples, **no intermediate ranges were considered**, such as 1-4.5% or 2.8-6.3%. Narita could be considered to show an even greater number of possible ranges if intermediate ranges are included and depending on how one determines what the possible ranges are. For example and as stated above, for a person using Narita as a basis for producing a glass having a BaO content in the range disclosed in Claim 20, he would have to pick a range that encompasses about 3.5%, such as 3-6.5% or 17-20.5%, from the overall range of 0-30%. Including intermediate ranges and by counting in 1% increments starting at zero, there are approximately 27 possible ranges of 3.5% in a 0-30% range (0-3.5, 1-4.5, 2-5.5...25-28.5, 26-29.5). Therefore, the person using Narita, in this particular example, would have an approximate 1 in 27 chance, or an approximately 3.7% chance, of picking the range for BaO disclosed in Claim 20. Including intermediate ranges and by counting in 0.5% increments starting at zero, there are approximately 54 possible ranges of 3.5% in a 0-30% range (0-3.5, 0.5-4, 1-4.5...25.5-29, 26-29.5, 26.5-30). Therefore, the person using Narita, in this particular example, would have an approximate 1 in 54 chance, or an approximately 1.85% chance, of picking the range for BaO disclosed in Claim 20.

In view of the above, it is respectfully submitted that the preferred ranges of all of the components of the present invention as claimed in Claim 20 would not be readily discerned or "clearly envisaged" using the broad ranges of Narita as a guide. It is respectfully submitted that Narita could not reasonably be considered

to teach, suggest, disclose, or render obvious the present invention as claimed.

It is thus submitted that the very large ranges for the mentioned eight glass components of the Narita et al. reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having **a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K;**
said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 65
B_2O_3	> 6 - 10.5
Al_2O_3	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	**> 5 - 8.5**
with SrO + BaO	**≤ 8.6**
with MgO + CaO + SrO + BaO	**8 - 18**
ZnO	0 - < 2." (emphasis added)

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The ranges of the present invention include only a very small portion of the ranges of the Narita et al. reference. Therefore, the Narita et al. reference is a non-teaching reference. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Narita et al. reference that would point to the specific ranges of the specific

components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Narita et al. reference.

In the following, the distinctions between the glass of Narita et al. reference and the glass of Applicants' Claim 20 are analyzed in detail and the analysis is summarized in the following Table 1.

Table 1 - Comparison Of Glass Of Narita et al.
And Glass Of Applicants' Claim 20

Component or Sum of Components	Narita's Ranges of Components	Overlap between Applicants' Ranges of Components and Narita's Ranges of Components	Ratio of Applicants' Ranges of Components to Narita's Ranges of Components	Running Probability
SiO_2	30%	7%	0.233	
B_2O_3	15%	4.5%	0.30	1 in 14
Al_2O_3	19%	11%	0.5789	1 in 25
MgO	10%	3%	0.30	1 in 83
CaO	15%	9%	0.60	1 in 138
SrO	10%	1.4%	0.14	1 in 984
BaO	30%	3.5%	0.116	1 in 8,485
ZnO	10%	2%	0.20	1 in 42,373
SrO + BaO	40%	3.5%	0.0875	1 in 483,092
MgO + CaO + SrO + BaO	65%	10%	0.154	1 in 3,134,796

1d. Explanation Of Ranges Of Components

i. Ranges F_r Silicon Di_xide And For Boric Oxide

The Narita et al. reference discloses a range of 40 wt% to 70 wt% of SiO_2. Therefore, the total numerical range of SiO_2 that is disclosed in the Narita et al. reference is the difference between 70 wt% and 40 wt% which is 30 wt%. In other words, the part of the 100% possible range of SiO_2 in the Narita et al. reference is 30%, or, expressed in fractional form rather than in terms of percentage, is 0.30 of the possible range of SiO_2. The value of 0.30, or more than one quarter of the possible range of SiO_2, is a substantial part of the possible 100% range of SiO_2.

The Narita et al. reference discloses a range of 5 wt% to 20 wt% of B_2O_3. Therefore, the total numerical range of B_2O_3 that is disclosed in the Narita et al. reference is the difference between 20 wt% and 5 wt% which is 15 wt%. In other words, the part of the 100% possible range of B_2O_3 in the Narita et al. reference is 15%, or, expressed in fractional form rather than in terms of percentage, is 0.15 of the possible range of B_2O_3. The value of 0.15 of the possible range of B_2O_3, is a moderately substantial part of the possible 100% range of B_2O_3.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of SiO_2 from more than 58 wt% to 65 wt%. Therefore, the total numerical range of SiO_2 that is claimed in Applicants' Claim 20 is the difference between 65 wt% and 58 wt% which is 7 wt%. In other words, the part of the 100% possible range of SiO_2 claimed in Claim 20 is 7%, or, expressed in fractional form rather than in terms of percentage, is 0.07 of the possible range of SiO_2. The value of

0.07 of the possible range of SiO_2 is a small part of the possible 100 % range of SiO_2.

Further in contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of B_2O_3 from more than 6 wt% to 10.5 wt%. Therefore, the total numerical range of B_2O_3 that is claimed in Applicants Claim 20 is the difference between 10.5 wt% and 6 wt% which is 4.5 wt%. In other words, the part of the 100% possible range of B_2O_3 claimed in Claim 20 is 4.5 %, or, expressed in fractional form rather than in terms of percentage, is 0.045 of the possible range of B_2O_3. The value of 0.045 of the possible range of B_2O_3 is a small part of the possible 100% range of B_2O_3.

For SiO_2, the Narita et al. reference discloses a range of 30 wt% and Applicants' Claim 20 claims a range of 7 wt%. The quotient of 7 wt% over 30 wt% represents the ratio of the range of SiO_2 as claimed in Claim 20 compared to the range of SiO_2 as disclosed in the Narita et al. reference. The quotient is 0.233. In other words, for SiO_2, the 7% of the range of Claim 20 is only 23% of the range of the Narita et al. reference, which range of the Narita et al. reference is 30% of the 100% possible range of the Narita et al. reference.

For B_2O_3, the Narita et al. reference discloses a range of 15 wt% and Applicants' Claim 20 claims a range of 4.5 wt%. The quotient of 4.5 wt% over 15 wt% represents the ratio of the range of B_2O_3 as claimed in Claim 20 compared to the range of B_2O_3 as disclosed in the Narita et al. reference. The quotient is 0.30. In other words, for B_2O_3, the 4.5% of the range of Claim 20 is only 30% of the range of the Narita et al. reference, which range of the

Narita et al. reference is 15% of the 100% possible range of the Narita et al. reference.

As is well known in the mathematics of combinations and probabilities, when two sub-ranges of two separate possible ranges are considered, the portion of the total range of the two separate possible ranges that these ranges take up is the product of the fraction that the first range takes up in the first possible range times the fraction that the second range takes up in the second possible range.

Expressed differently, the probability of all the possible ranges and the position of all the possible ranges that the two ranges of SiO_2 and B_2O_3 occupy in the two possible greater ranges, that is to say, of all the possible ranges in the two large ranges, that is, in the case of SiO_2, 30 wt% for the Narita et al. reference and 7 wt% for Claim 20 and, in the case of B_2O_3, 15 wt% for the Narita et al. reference and 4.5 wt% for Claim 20, is the product of 0.233 times 0.30, which is equal to 0.0699.

Expressed differently, the probability that the two ranges of SiO_2 and B_2O_3 would encompass the ranges of Claim 20 is 0.0699 or 6.99%.

Thus, in the case of a 0.233 chance for SiO_2 and a 0.30 chance for B_2O_3, the probability that these two would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 6.99% chance. That means that 93.01% of the possible ranges of SiO_2 and B_2O_3 would lie outside of the ranges claimed for SiO_2 and B_2O_3. In other words, the possibility that these two ranges would be in different positions in the ranges of the Narita et al.

reference is 93.01% and would lie outside the ranges claimed in Claim 20.

It is submitted that the low percentage of 6.99% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.0699 is 14.30. In other words, Applicants' Claim 20 covers only $^{1}/_{14}$ of the ranges as disclosed by the Narita et al. reference for the two components, SiO_2 and B_2O_3.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2 and of from more than 6 wt% to 10.5 wt% for B_2O_3, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2 and of from 5 wt% to 20 wt% for B_2O_3 in the Narita et al. reference, is **only 6.99%**. Therefore, 93.01% of the possible ranges for SiO_2 and B_2O_3 of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2 and B_2O_3. In contrast, Applicants' Claim 20 covers only a $^{1}/_{14}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2 and B_2O_3 compared to these two components of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2 and B_2O_3.

ii. Ranges For Aluminum Oxide

The Narita et al. reference discloses a range of 6 wt% to 25 wt% of Al_2O_3. Therefore, the total numerical range of Al_2O_3 that is disclosed in the Narita et al. reference is the difference between

25 wt% and 6 wt% which is 19 wt%. In other words, the part of the 100% possible range of Al_2O_3 in the Narita et al. reference is 19%, or, expressed in fractional form rather than in terms of percentage, is 0.19 of the possible range of Al_2O_3. The value of 0.19 is a moderately substantial part of the possible 100% range of Al_2O_3.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of Al_2O_3 from more than 14 wt% to 25 wt%. Therefore, the total numerical range of Al_2O_3 that is claimed in Applicants Claim 20 is the difference between 25 wt% and 14 wt% which is 11 wt%. In other words, the part of the 100% possible range of Al_2O_3 claimed in Claim 20 is 11%, or, expressed in fractional form rather than in terms of percentage, is 0.11 of the possible range of Al_2O_3. The value of 0.11 of the possible range of Al_2O_3 is a moderately substantial part of the possible 100% range of Al_2O_3.

For Al_2O_3, the Narita et al. reference discloses a range of 19 wt% and Applicants' Claim 20 claims a range of 11 wt%. The quotient of 11 wt% over 19 wt% represents the ratio of the range of Al_2O_3 as claimed in Claim 20 compared to the range of Al_2O_3 as disclosed in the Narita et al. reference. The quotient is 0.5789. In other words, for Al_2O_3, the 11% of the range of Claim 20 is 58% of the range of the Narita et al. reference, which range of the Narita et al. reference is 19% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the three glass components, SiO_2, B_2O_3, and Al_2O_3, the probability that the three ranges would encompass the ranges of Claim 20 is 0.0699 times 0.5789 which is 0.04046 or 4.05%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for

B_2O_3, and a 0.5789 chance for Al_2O_3, the probability that these three would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 4.05% chance. That means that 95.95% of the possible ranges of SiO_2, B_2O_3 and Al_2O_3 would lie outside of the ranges claimed for SiO_2, B_2O_3, and Al_2O_3. In other words, the possibility that these three ranges would be in different positions in the ranges of the Narita et al. reference is 95.95% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 4.05% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.04046 is 24.71. In other words, Applicants' Claim 20 covers only $^1/_{25}$ of the ranges as disclosed by the Narita et al. reference for the three components, SiO_2, B_2O_3, and Al_2O_3.

Accordingly, since the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, and of from more than 14 wt% to 25 wt% for Al_2O_3, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, and of from 6 wt% to 25 wt% for Al_2O_3 in the Narita et al. reference, is **only 4.05%**. Therefore 95.95% of the possible ranges for SiO_2, B_2O_3, and Al_2O_3 for the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, and Al_2O_3. In contrast, Applicants' Claim 20 covers only $^1/_{25}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, and Al_2O_3 compared to these three components of the Narita et al. reference. Therefore,

the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, and Al_2O_3.

iii. Ranges for Magnesium Oxide

The Narita et al. reference discloses a range of 0 wt% to 10 wt% of MgO. Therefore, the total numerical range of MgO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of MgO in the Narita et al. reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of MgO. The value of 0.1 is a moderately substantial part of the possible 100% range of MgO.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of MgO from 0 wt% to less than 3 wt%. Therefore, the total numerical range of MgO that is claimed in Applicants Claim 20 is the difference between 3 wt% and 0 wt% which is 3 wt%. In other words, the part of the 100% possible range of MgO claimed in Claim 20 is 3%, or, expressed in fractional form rather than in terms of percentage, is 0.03 of the possible range of MgO. The value of 0.03 of the possible range of MgO is a small part of the possible 100% range of MgO.

For MgO, the Narita et al. reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 3 wt%. The quotient of 3 wt% over 10 wt% represents the ratio of the range of MgO as claimed in Claim 20 compared to the range of MgO as disclosed in the Narita et al. reference. The quotient is 0.30. In other words, for MgO, the 3% of the range of Claim 20 is 30% of the range of the Narita et al. reference, which range of the Narita et al.

reference is 10% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the four glass components, SiO_2, B_2O_3, Al_2O_3, and MgO, the probability that the four ranges would encompass the ranges of Claim 20 is 0.04046 times 0.30 which is 0.0121 or 1.2%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, and a 0.3 chance for MgO, the probability that these four would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 1.2% chance. That means that 98.8% of the possible ranges of SiO_2, B_2O_3, Al_2O_3 and MgO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, and MgO. In other words, the possibility that these four ranges would be in different positions in the ranges of the Narita et al. reference is 98.8% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 1.2% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.0121 is 82.648. In other words, Applicants' Claim 20 covers only $^1/_{83}$ of the ranges as disclosed by the Narita et al. reference for the four components, SiO_2, B_2O_3, Al_2O_3, and MgO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, and of from 0 wt% to less than 3 wt% for MgO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt%

to 25 wt% for Al_2O_3, and of from 0 wt% to 10 wt% for MgO in the Narita et al. reference, is **only 1.2%**. Therefore, 98.8% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, and MgO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, and MgO. In contrast, Applicants' Claim 20 covers only $^1/_{83}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, and MgO compared to these four components of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, and MgO.

iv. Ranges for Calcium Oxide

The Narita et al. reference discloses a range of 0 wt% to 15 wt% of CaO. Therefore, the total numerical range of CaO that is disclosed in the Narita et al. reference is the difference between 15 wt% and 0 wt% which is 15 wt%. In other words, the part of the 100% possible range of CaO in the Narita et al. reference is 15%, or, expressed in fractional form rather than in terms of percentage, is 0.15 of the possible range of CaO. The value of 0.15 is a moderately substantial part of the possible 100% range of CaO.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of CaO from 0 wt% to 9 wt%. Therefore, the total numerical range of CaO that is claimed in Applicants Claim 20 is the difference between 9 wt% and 0 wt% which is 9 wt%. In other words, the part of the 100% possible range of CaO claimed in Claim 20 is

9%, or, expressed in fractional form rather than in terms of percentage, is 0.09 of the possible range of CaO. The value of 0.09 of the possible range of CaO is a small part of the possible 100% range of CaO.

For CaO, the Narita et al. reference discloses a range of 15 wt% and Applicants' Claim 20 claims a range of 9 wt%. The quotient of 9 wt% over 15 wt% represents the ratio of the range of CaO as claimed in Claim 20 compared to the range of CaO as disclosed in the Narita et al. reference. The quotient is 0.6. In other words, for CaO, the 9% of the range of Claim 20 is 60% of the range of the Narita et al. reference, which range of the Narita et al. reference is 15% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the five glass components, SiO_2, B_2O_3, Al_2O_3, MgO, and CaO the probability that the five ranges would encompass the ranges of Claim 20 is 0.0121 times 0.6 which is 0.00726 or 0.7%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, and a 0.6 chance for CaO, the probability that these five would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 0.7% chance. That means that 99.3% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, and CaO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, and CaO. In other words, the possibility that these five ranges would be in different positions in the ranges of the Narita et al. reference is 99.3% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.7% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.00726 is 137.74. In other words, Applicants' Claim 20 covers only $^{1}/_{138}$ of the ranges as disclosed by the Narita et al. reference for the five components, SiO_2, B_2O_3, Al_2O_3, MgO, and CaO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, and of from 0 wt% to 9 wt% for CaO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, and of from 0 wt% to 15 wt% for CaO in the Narita et al. reference, is **only 0.7%**. Therefore, 99.3% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, and MgO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, and MgO. In contrast, Applicants' Claim 20 covers only a $^{1}/_{138}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, and MgO compared to these four components of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, and MgO.

<u>**v. Ranges for Strontium Oxide**</u>

The Narita et al. reference discloses a range of 0 wt% to 10 wt% of SrO. Therefore, the total numerical range of SrO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of SrO in the Narita et al. reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of SrO. The value of 0.10 is a moderately substantial part of the possible 100% range of SrO.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of SrO from 0.1 wt% to 1.5 wt%. Therefore, the total numerical range of SrO that is claimed in Applicants Claim 20 is the difference between 1.5 wt% and 0.1 wt% which is 1.4 wt%. In other words, the part of the 100% possible range of SrO claimed in Claim 20 is 1.4%, or, expressed in fractional form rather than in terms of percentage, is 0.014 of the possible range of SrO. The value of 0.014 of the possible range of SrO is a small part of the possible 100% range of SrO.

For SrO, the Narita et al. reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 1.4 wt%. The quotient of 1.4 wt% over 10 wt% represents the ratio of the range of SrO as claimed in Claim 20 compared to the range of SrO as disclosed in the Narita et al. reference. The quotient is 0.14. In other words, for SrO, the 1.4% of the range of Claim 20 is 14% of the range of the Narita et al. reference, which range of the Narita et al. reference is 10% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the six glass components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, and SrO the

probability that the six ranges would encompass the ranges of Claim 20 is 0.00726 times 0.14 which is 0.001016 or 0.102%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, a 0.6 chance for CaO, and a 0.14 chance for SrO the probability that these six would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 0.102% chance. That means that 99.898% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, and SrO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, and SrO. In other words, the possibility that these six ranges would be in different positions in the ranges of the Narita et al. reference is 99.898% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.102% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.001016 is 983.86. In other words, Applicants' Claim 20 covers only $^1/_{984}$ of the ranges as disclosed by the Narita et al. reference for the six components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, and SrO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, and of from 0.1 wt% to 1.5 wt% for SrO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, and of from 0 wt% to 10 wt% for SrO in the

Narita et al. reference, is **only 0.102%**. Therefore, 99.898% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, MgO and SrO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, MgO and SrO. In contrast, Applicants' Claim 20 covers only a $^1/_{984}$ probability of the range as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, MgO and SrO compared to these six components of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, MgO and SrO.

vi. Ranges for Barium Oxide

The Narita et al. reference discloses the large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita et al. reference is the difference between 30 wt% and 0 wt% which is 30 wt%. In other words, the part of the 100% possible range of BaO in the Narita et al. reference is 30%, or, expressed in fractional form rather than in terms of percentage, is 0.30 of the possible range of BaO. The value of 0.30 is a moderately substantial part of the possible 100% range of BaO.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of BaO from more than 5 wt% to 8.5 wt%. Therefore, the total numerical range of BaO that is claimed in Applicants Claim 20 is the difference between 8.5 wt% and 5 wt% which is 3.5 wt%. In other words, the part of the 100% possible range of BaO claimed

in Claim 20 is 3.5%, or, expressed in fractional form rather than in terms of percentage, is 0.035 of the possible range of BaO. The value of 0.035 of the possible range of BaO is a small part of the possible 100% range of BaO.

For BaO, the Narita et al. reference discloses a range of 30 wt% and Applicants' Claim 20 claims a range of 3.5 wt%. The quotient of 3.5 wt% over 30 wt% represents the ratio of the range of BaO as claimed in Claim 20 compared to the range of BaO as disclosed in the Narita et al. reference. The quotient is 0.116. In other words, for BaO, the 3.5% of the range of Claim 20 is 12% of the range of the Narita et al. reference, which range of the Narita et al. reference is 30% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the seven glass components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO the probability that the seven ranges would encompass the ranges of Claim 20 is 0.001016 times 0.116 which is 0.000118 or 0.012%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, and a 0.116 chance for BaO the probability that these seven would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 0.012% chance. That means that 99.988% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO. In other words, the possibility that these seven ranges would be in different positions in the ranges of the Narita et al. reference is 99.988% and

would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.012% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.000118 is 8484.9. In other words, Applicants' Claim 20 covers only $^{1}/_{8485}$ of the ranges as disclosed by the Narita et al. reference for the seven components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, and of from more than 5 wt% to 8.5 wt% for BaO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, and of from 0 wt% to **30 wt% for BaO** in the Narita et al. reference, is **only 0.012%**. Therefore, 99.988% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO. In contrast, Applicants' Claim 20 covers only a $^{1}/_{8485}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO compared to these seven components of the Narita et al. reference. Therefore, the Narita et al. reference does not make

obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, and BaO.

vii. Ranges for Zinc Oxide

The Narita et al. reference discloses the range of 0 wt% to 10 wt% of ZnO. Therefore, the total numerical range of ZnO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%. In other words, the part of the 100% possible range of BaO in the Narita et al. reference is 10%, or, expressed in fractional form rather than in terms of percentage, is 0.10 of the possible range of ZnO. The value of 0.10 is a moderately substantial part of the possible 100% range of ZnO.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of ZnO from 0 wt% to less than 2 wt%. Therefore, the total numerical range of ZnO that is claimed in Applicants Claim 20 is the difference between 2 wt% and 0 wt% which is 2 wt%. In other words, the part of the 100% possible range of ZnO claimed in Claim 20 is 2%, or, expressed in fractional form rather than in terms of percentage, is 0.02 of the possible range of ZnO. The value of 0.02 of the possible range of ZnO is a small part of the possible 100% range of ZnO.

For ZnO, the Narita et al. reference discloses a range of 10 wt% and Applicants' Claim 20 claims a range of 2 wt%. The quotient of 2 wt% over 10 wt% represents the ratio of the range of ZnO as claimed in Claim 20 compared to the range of ZnO as disclosed in the Narita et al. reference. The quotient is 0.20. In other words, for ZnO, the 2% of the range of Claim 20 is 20% of the range of the Narita et al. reference, which range of the Narita et al.

reference is 10% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the eight glass components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO the probability that the eight ranges would encompass the ranges of Claim 20 is 0.000118 times 0.20 which is 0.0000236 or 0.00236% or 23.6 x 10^{-4}%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, a 0.116 chance for BaO, and a 0.20 chance for ZnO the probability that these eight would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 23.6 x 10^{-4}% chance. That means that 99.99764% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO. In other words, the possibility that these eight ranges would be in different positions in the ranges of the Narita et al. reference is 99.99764% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.00236% is a very small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.0000236 is 42,372.88. In other words, Applicants' Claim 20 covers only $^1/_{42373}$ of the ranges as disclosed by the Narita et al. reference for the eight components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65

wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, of from more than 5 wt% to 8.5 wt% for BaO, and of from 0 wt% to less than 2 wt% for ZnO, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, of from 0 wt% to **30 wt% for BaO**, and of from 0 wt% to 10 wt% for ZnO in the Narita et al. reference, is **only 23.6×10^{-4}%**. Therefore, 99.99764% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO. In contrast, Applicants' Claim 20 covers only a $^{1}/_{42373}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims a very small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO compared to these eight components of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO.

viii. Ranges For Sum Of Strontium Oxide Plus Barium Oxide

For the sum of SrO plus BaO Applicants claim a range of less than 8.6 wt%.

The Narita et al. reference does not disclose any range for the

sum of SrO plus BaO.

However, for the completeness of the presentation regarding Claim 20, in the following the probability of such limits using the foregoing calculation is presented.

The Narita et al. reference discloses the range of 0 wt% to 10 wt% of SrO. Therefore, the total numerical range of SrO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita et al. reference discloses the very large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita et al. reference is the difference between 30 wt% and 0 wt% which is 30 wt%.

In the case of the Narita et al. reference, the sum of SrO plus BaO is 10 wt% of SrO plus 30 wt% of BaO which is equal to 40 wt%.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of less than 8.6 wt% for SrO plus BaO. Claim 20 also recites a minimum of 0.1 wt% for SrO and a minimum of greater than 5 wt% for BaO, for a minimum total for SrO plus BaO of 5.1 wt%. Therefore, the total numerical range of SrO plus BaO that is claimed in Applicants Claim 20 is the difference between 8.6 wt% and 5.1 wt% which is 3.5 wt%.

For SrO plus BaO, the Narita et al. reference discloses a range of 40 wt% and Applicants' Claim 20 claims a range of 3.5 wt%. The quotient of 3.5 wt% over 40 wt% represents the ratio of the range of SrO plus BaO as claimed in Claim 20 compared to the range of SrO plus BaO as disclosed in the Narita et al. reference. The quotient is 0.0875. In other words, for SrO plus BaO, the 3.5% of the range of Claim 20 is 9% of the range of the Narita et al. reference, which

range of the Narita et al. reference is 40% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the eight glass components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO, the probability that the nine ranges would encompass the ranges of Claim 20 is 0.0000236 times 0.215 which is 0.00000207 or 0.000207% or 2.07×10^{-4}%.

Thus, in the case of a 0.233 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, a 0.116 chance for BaO, and a 0.20 chance for ZnO, and a 0.0875 chance for the sum of SrO plus BaO the probability that these nine would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 2.07×10^{-4}%. That means that 99.99999793% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO. In other words, the possibility that these nine ranges would be in different positions in the ranges of the Narita et al. reference is 99.99999793% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 2.07×10^{-4}% is an extremely small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.00000207 is 483,092. In other words, Applicants' Claim 20 covers only $^{1}/_{483092}$ of the ranges as disclosed by the Narita et al. reference for the eight components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO.

Accordingly, the probability of a person skilled in the art

choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, of from more than 5 wt% to 8.5 wt% for BaO, and of from 0 wt% to less than 2 wt% for ZnO, with the sum of SrO plus BaO of from more than 5.1 wt% to 8.6 wt%, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, of from 0 wt% to 30 wt% for BaO, and of from 0 wt% to 10 wt% for ZnO, and with the sum of SrO plus BaO of 40 wt% in the Narita et al. reference, is **only 2.07 x 10^{-4}%**. Therefore, 99.99999793% of the possible ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO. In contrast, Applicants" Claim 20 covers only a $^1/_{483092}$ probability as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims an extremely small range, which represents an extremely small probability, of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO compared to the these eight components and the sum of SrO plus BaO of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the sum of SrO plus BaO.

ix. Ranges For Sum Of Magnesium Oxide plus Calcium Oxide Plus Strontium Oxide Plus Barium Oxide

For the sum of MgO plus CaO plus SrO plus BaO, Applicants claim the range of from 8 wt% to 18 wt%.

The Narita et al. reference does not disclose any range for the sum of MgO plus CaO plus SrO plus BaO.

However, for the completeness of the presentation regarding Claim 20, in the following the probability of such limits using the foregoing calculation is presented.

The Narita et al. reference discloses the range of 0 wt% to 10 wt% of MgO. Therefore, the total numerical range of MgO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita et al. reference discloses the range of 0 wt% to 15 wt% of CaO. Therefore, the total numerical range of CaO that is disclosed in the Narita et al. reference is the difference between 15 wt% and 0 wt% which is 15 wt%.

The Narita et al. reference discloses the range of 0 wt% to 10 wt% of SrO. Therefore, the total numerical range of SrO that is disclosed in the Narita et al. reference is the difference between 10 wt% and 0 wt% which is 10 wt%.

The Narita et al. reference discloses the very large range of 0 wt% to 30 wt% of BaO. Therefore, the total numerical range of BaO that is disclosed in the Narita et al. reference is the difference between 30 wt% and 0 wt% which is 30 wt%.

In the case of the Narita et al. reference, the sum of MgO plus CaO plus SrO plus BaO is 10 wt% of MgO plus 15 wt% of CaO plus 10 wt% of SrO plus 30 wt% of BaO which is equal to 65 wt%.

In contrast to the Narita et al. reference, Applicants' Claim 20 claims a range of from 8 wt% to 18 wt% for the sum of MgO plus CaO plus SrO plus BaO. Therefore, the total numerical range of MgO plus CaO plus SrO plus BaO that is claimed in Applicants Claim 20 is the difference between 18 wt% and 8 wt% which is 10 wt%.

For MgO plus CaO plus SrO plus BaO, the Narita et al. reference discloses a range of 65 wt% and Applicants' Claim 20 claims a range of 10 wt%. The quotient of 10 wt% over 65 w% represents the ratio of the range of the sum of MgO plus CaO plus SrO plus BaO claimed in Claim 20 compared to the range of the sum of MgO plus CaO plus SrO plus BaO as disclosed in the Narita et al. reference. The quotient is 0.154. In other words, for the sum of MgO plus CaO plus SrO plus BaO, the 10% of the range of Claim 20 is 15% of the range of the Narita et al. reference, which range of the Narita et al. reference is 75% of the 100% possible range of the Narita et al. reference.

Applying the above-described probability calculation to the eight glass components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO, the probability that the ten ranges would encompass the ranges of Claim 20 is 0.00000207 times 0.154 which is 0.000000319 or 0.0000319% or 0.319×10^{-4}%.

Thus, in the case of a 0.2333 chance for SiO_2, a 0.30 chance for B_2O_3, a 0.5789 chance for Al_2O_3, a 0.3 chance for MgO, a 0.6 chance for CaO, a 0.14 chance for SrO, a 0.116 chance for BaO, and a 0.20 chance for ZnO, and a 0.0875 chance for the sum of SrO plus BaO, and a 0.154 chance for the sum of MgO plus CaO plus SrO

plus BaO the probability that these ten ranges would exist together in Applicants' Claim 20 on the basis of the Narita et al. reference is only a 0.319×10^{-4}% chance. That means that substantially 100% of the possible ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO would lie outside of the ranges claimed for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO. In other words, the possibility that these nine ranges would be in different positions in the ranges of the Narita et al. reference is 99.9999219 or substantially 100% and would lie outside the ranges claimed in Claim 20.

It is again submitted that the low percentage of 0.319×10^{-4}% is an exceedingly small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.000000319 is 3,134,796. In other words, Applicants' Claim 20 covers only $^{1}/_{3134796}$ of the ranges as disclosed by the Narita et al. reference for the eight components, SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO.

Accordingly, the probability of a person skilled in the art choosing the ranges of Claim 20 of from more than of 58 wt% to 65 wt% for SiO_2, of from more than 6 wt% to 10.5 wt% for B_2O_3, of from more than 14 wt% to 25 wt% for Al_2O_3, of from 0 wt% to less than 3 wt% for MgO, of from 0 wt% to 9 wt% for CaO, of from 0.1 wt% to 1.5 wt% for SrO, of from more than 5 wt% to 8.5 wt% for BaO, and of from 0 wt% to less than 2 wt% for ZnO, with the sum of SrO plus BaO of not more than 8.6 wt%, and with the sum of MgO plus CaO

plus SrO plus BaO of from 8 wt% to 18 wt%, while being aware of the ranges of from 40 wt% to 70 wt% for SiO_2, of from 5 wt% to 20 wt% for B_2O_3, of from 6 wt% to 25 wt% for Al_2O_3, of from 0 wt% to 10 wt% for MgO, of from 0 wt% to 15 wt% for CaO, of from 0 wt% to 10 wt% for SrO, of from 0 wt% to 30 wt% for BaO, and of from 0 wt% to 10 wt% for ZnO, with the sum of SrO plus BaO of 40 wt%, and with the sum of MgO plus CaO plus SrO plus BaO of 65 wt% in the Narita et al. reference, is **only 0.319 x 10^{-4}%**. Therefore, 99.999999681% of the possible range for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO, of the Narita et al. reference represent the probability of being outside of the claimed ranges for SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO. In contrast, Applicants' Claim 20 covers only a $^{1}/_{3134796}$ probability of the ranges as disclosed in the Narita et al. reference.

Thus, Applicants' Claim 20 claims an exceedingly small range, which represents a very small probability, of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO compared to these eight components, the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO of the Narita et al. reference. Therefore, the Narita et al. reference does not make obvious Applicants' Claim 20 with respect to the ranges of SiO_2, B_2O_3, Al_2O_3, MgO, CaO, SrO, BaO, and ZnO, and the ranges of the sum of SrO plus BaO, and the sum of MgO plus CaO plus SrO plus BaO.

Multiplication of all the ratios of Applicants' range of components vs. Narita's range of components reveals a result of 0.000000319

which corresponds to 0.0000319%.

The low percentage of 0.0000319 is an extremely small percentage of the total range of possibilities as suggested in the Narita et al. reference. The reciprocal of 0.000000319 is 3,134,796. In other words, there are over 3,134,796 other ranges covered by the Narita et al. reference of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 3,134,796 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $^{1}/_{3134796}$ probability of the ranges that are covered by the Narita et al. reference.

Thus, it is not understood how the Narita et al. reference can make Applicants' range obvious. It is submitted that the Narita et al. reference is not applicable as a reference because of the minuscule factor of 0.00319×10^{-4}.

It is submitted that the foregoing differences of Applicants' glass alone are sufficient to show the patentable distinction over the Narita et al. reference.

As mentioned, there is no disclosure in the Narita et al. reference of the sum of SrO plus BaO being at most 8.6%. There is also no disclosure in the Narita et al. reference of the sum of MgO plus CaO plus SrO + BaO being in the range of from 8 % to 18 %. The importance of a specific BaO content in Applicants' glass will be discussed in further detail herein below.

It is clear from the foregoing comparison, that Applicants' invention is a selection invention of specific and well-defined ranges that are not obvious over the Narita et al. reference. More

specifically, Applicants' glass is claimed in terms of small ranges within the very wide ranges of the Narita et al. reference. The specific and well-defined ranges of Applicants' glass from within the Narita et al. reference lead to surprising results as will be discussed in greater detail below.

Furthermore, please note, as claimed in Claim 20, Applicants' glass contains the specific range of from more than 5 % to 8.5 % by weight of BaO.

In Table 3 of the Narita et al. reference, sample 1 has a BaO content of 9.5 % by weight.

In Table 3 of the Narita et al. reference, sample 2 has a BaO content of 24.5 % by weight.

In Table 3 of the Narita et al. reference, sample 4 has a BaO content of 25.0 % by weight.

In Table 3 of the Narita et al. reference, sample 5 has a BaO content of 12.0 % by weight.

In Table 4 of the Narita et al. reference, sample 6 does not contain BaO.

In Table 4 of the Narita et al. reference, sample 7 has a BaO content of 12.0 % by weight.

In Table 4 of the Narita et al. reference, sample 8 has a BaO content of 4.0 % by weight.

In contrast to the seven samples of Tables 3 and 4 of the Narita et al. reference discussed herein above, the glass of the present invention has a BaO content of from more than 5 % to 8.5.

Among the samples from Tables 3 and 4 of the Narita et al. reference, in Table 4, sample 6 has a BaO content of 0% which is below the lower limit of more than 5% by weight claimed in Claim 20.

In Table 4, sample 8 has a BaO content of 4.0% which is also below the lower limit of more than 5% of BaO claimed in Claim 20. The samples In Table 3, samples 1, 2, 4, and 5, and the sample in Table 4, sample 7, have a greater percentage than the upper limit of 8.5% BaO claimed in Claim 20. Thus, with respect to these seven samples, the Narita et al. reference discloses BaO contents that are clearly **outside** of the claimed range of BaO of from more than 5% to 8.5% by weight.

Therefore, the seven samples, in Table 3 samples 1, 2, 4, and 5 of Table 3, and in Table 4 samples 6, 7, and 8 of the Narita et al. reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing a BaO content of from more than 5% to 8.5% by weight, because the BaO content disclosed in these seven samples of the Narita et al. reference is well outside of the range of BaO.

It is submitted that the glass art is an unpredictable art. Thus, any change in the composition of a glass could not predict the outcome of that glass and thus the outcome would be unpredictable. Further, what may appear to be a predictable outcome regarding glass compositions is not predictable and any appearance of predictability in this case is based on the use of hindsight, which is improper in determining obviousness.

Table 1 of the Narita et al. reference discloses five samples, samples a, b, c, d, and e, that each have a BaO content of 6% by weight. The BaO content of 6% by weight disclosed in Table 1 for the samples a, b, c, d, and e of the Narita et al. reference is within Applicants' claimed range of BaO of from more than 5% to 8.5% by weight. However, the Narita et al. reference discloses an Al_2O_3

content of 16.0% by weight for the samples a, b, c, d, and e of Table 1. The Al_2O_3 content of 16 % of the Narita et al. reference is **outside** the A_2O_3 content of from more than 18% to 24% by weight claimed in Claim 20. Furthermore, the Narita et al. reference discloses an MgO content of 4.0% by weight for each of the samples a, b, c, d, and e of Table 1. This MgO content of 4% by weight of the Narita et al. reference is also **outside** of the MgO content of from 0% to less than 3% by weight claimed in Claim 20.

In the five samples in Table 1, samples a, b, c, d, and e, of the Narita et al. reference, both components, Al_2O_3 and MgO, are **outside** of the range of Applicants' Al_2O_3 and MgO content claimed in Claim 20.

It is submitted that it would be sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable.

In Table 1 five samples, samples a, b, c, d, and e, of the Narita et al. reference both components, Al_2O_3 and MgO, are outside of the range of the content of Al_2O_3 and MgO claimed in Claim 20. Therefore, the five Table 1 samples of the Narita et al. reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an A_2O_3 content of from more than 18% to 24% by weight, because the A_2O_3 content disclosed in the Narita et al. reference for the five samples is well outside of the range of A_2O_3 content as claimed in Claim 20. Furthermore, the five Table 1 samples of the Narita et al. reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an MgO content of from 0% to less than 3% by weight, because the MgO content disclosed in the Narita et al. reference for the five Table 1

samples is well outside of the range of MgO content as claimed in Claim 20.

Table 2 of the Narita et al. reference discloses six samples, samples e-1, e-2, e, e-3, e-4 and e-5, that variously have a BaO content of from 5.6% to 6.2% by weight. The BaO content disclosed in six samples of Table 2 of the Narita et al. reference is within Applicants' range of more than 5% to 8.5% by weight of BaO. However, the Al_2O_3 content variously given as from 15.0% to 16.5 % by weight of Al_2O_3 for the six samples in Table 2, samples e-1, e-2, e, e-3, e-4 and e-5, of the Narita et al. reference. This is **outside** of Claim 20 which claims an Al_2O_3 content of more than 18% to 24% by weight. Also, the MgO content variously given as from 3.7% to 4.1% by weight for the samples in Table 2 of the Narita et al. reference is **outside** of Claim 20 which claims an MgO content of from 0 % to less than 3% by weight.

In the six samples of Table 2, samples e-1, e-2, e, e-3, e-4 and e-5, of the Narita et al. reference, both components, Al_2O_3 and MgO, are **outside** of the range of Applicants' Al_2O_3 and MgO content claimed in Claim 20.

It is again submitted that it would be sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable.

In the six samples of Table 2, samples e-1, e-2, e, e-3, e-4 and e-5, of the Narita et al. reference, both components, Al_2O_3 and MgO, are again **outside** of the range of the claimed components. Therefore, the six samples of Table 2 of the Narita et al. reference, discussed herein above, do not suggest and do not make obvious Applicants' glass containing an A_2O_3 content of from more than 18% to 24% by

weight, because the A_2O_3 content disclosed in the Narita et al. reference for the six samples of Table 2 is well outside of the range of A_2O_3 content as claimed in Claim 20. Furthermore, the six samples of Table 2 of the Narita et al. reference discussed herein above, do not suggest and do not make obvious Applicants' glass containing an MgO content of from 0% to less than 3% by weight, because the MgO content disclosed in the Narita et al. reference for the six samples of table 2 is well outside of the range of MgO content as claimed in Claim 20.

In Table 3 of the Narita et al. reference, sample 3 has a BaO content of 6% by weight. The BaO content of 6 % by weight disclosed in Table 3 for sample 3 is within Applicants' claimed range of BaO of from more than 5% to 8.5% by weight. However, the Al_2O_3 content of 15.0% by weight disclosed in sample 3 of Table 3 of the Narita et al. reference is **outside** of Applicants' Claim 20 which claims an Al_2O_3 content of more than 18% to 24% by weight.

It is submitted that it is sufficient for one of the components of the claimed invention to be outside the applied art to make the claimed invention patentable. In the case of sample 3 of Table 3 of the Narita et al. reference, the Al_2O_3 content is outside of the range of the claimed components. Therefore, sample 3 of Table 3 of the Narita et al. reference, discussed herein above, does not suggest and does not make obvious Applicants' glass containing an A_2O_3 content of from more than 18% to 24% by weight, because the A_2O_3 content of 6.0% by weight disclosed in the Narita et al. reference for sample 3 of Table 3 is well outside of the range of A_2O_3 content as claimed in Claim 20.

It is again submitted that the glass art is an unpredictable art.

Thus, any change in the composition of a glass could not predict the outcome of that glass and thus the outcome would be unpredictable. Further, what may appear to be a predictable outcome regarding glass compositions is not predictable and any appearance of predictability in this case is based on the use of hindsight, which is improper in determining obviousness.

The glass claimed in Claim 20 has a "**coefficient of thermal expansion** $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K." (emphasis added.) The glass having a BaO content of from more than 5 % to 8.5 % by weight, and the other specific ranges of the other components in Claim 20 result in a low coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K, because the claimed glass composition provides for the network builders that enhance crystallization. In other words, the combination of the components claimed in Claim 20 is formulated in such a way as to produce a low coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K. This permits the glass to have an expansion behavior in the same range as both, amorphous silicon and polycrystalline silicon. Therefore amorphous silicon and polycrystalline silicon can be disposed on the substrate glass as claimed in Claim 20 and the shear between silicon coated on the claimed glass substrate and the glass substrate will be minimized. Furthermore, a low coefficient of thermal expansion as claimed in Claim 20 results in the glass having a high resistance against thermal shock and also having a high temperature strength retention, that is, the glass retains its strength upon being subjected to high temperatures.

The Narita et al. reference, as understood, contains no indication that suggests that the glasses of the Narita et al. reference

have a low coefficient of thermal expansion of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K. Therefore, the Narita et al. reference, as understood, does not suggest or make obvious the combination of the specific composition and the specific ranges and the low coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K of Claim 20.

It is submitted that the present invention is not obvious over the Narita et al. reference based on the foregoing.

It is also submitted that hindsight has been used to reject the claims of the present invention. However the use of hindsight is improper in determining obviousness.

1e. Further Discussion Of Distinctions Of Claim 20 Over Narita et al.

Applicants' glass as claimed in Claim 20 is not obvious in view of the Narita et al. reference further because of the following:

The glass claimed in Claim 20 has the following beneficial and surprising **properties**.

The combination of the specific claimed ranges of the glass claimed in Claim 20 provides a **high heat resistance** to minimize damage to the glass due to thermal shock on the glass. A heat resistant glass according to the "Dictionary of Ceramic Science and Engineering," by Loran S. O'Bannon, Plenum Press, New York, 1984 comprises:

> "A glass of low-thermal expansion and high resistance to thermal shock such as occurs when the glass is cooled suddenly from an elevated temperature."

Discussion Of The Glass Transition Temperature:

The term glass transition temperature is defined in the German publication "ABC GLAS," Deutscher Verlag für Grundstoffindustrie, Leipzig, 1991. The translation of the term is as follows:

> "**Transition temperature**, transition point, freezing point (formula sign T_g) - the temperature value which characterizes the region of the transformation of the glass melt from the condition of an undercooled or supercooled liquid into a quasi-solid ("frozen") condition (*transformation region, freezing region*). ...".

As understood, there is no suggestion in the Narita et al. reference of a glass transition temperature, T_g. Instead, the Narita et al. reference mentions the strain point, i.e., the temperature at the viscosity of $10^{14.5}$ dPas. The strain point temperature is usually about 25 K lower than the glass transition temperatures, T_g. Perusal of the tables of the Narita et al. reference indicates that the strain point temperature of the glasses of the Narita et al. reference is in the range of from 590 degrees Celsius to 705 degrees Celsius. The temperatures of from 590 degrees Celsius to 705 degrees Celsius, as understood, indicate glass transition temperatures, T_g, for the glasses of the Narita et al. reference of from 565 degrees Celsius to 680 degrees Celsius.

In contrast, in the present invention the glass as claimed in Claim 20, due to its specific composition and the specific ranges of the components, has **a high glass transition temperature, T_g.**, compared to Narita et al. A high glass transition temperature, T_g, of a glass provides a high heat resistance which is conducive to minimize damage to the glass due to thermal shock on the glass.

Applicants' glass has a high glass transition temperature, T_g, of more than 700 degrees Celsius, see page 18, lines 8-9.

The glass transition temperatures of the glasses of the Narita et al. reference are from 565 degrees Celsius to 680 degrees Celsius and are thus below the glass transition temperature, T_g, that applies to the glass claimed in Claim 20, that is, a glass transition temperature, T_g, of more than 700 degrees Celsius.

Even though the claimed glass has a **high** glass transition temperature, T_g, of more than 700 degrees Celsius, due to the combination of the specific claimed ranges of the glass and the specific composition of Applicants' glass, the claimed glass also has both, a **<u>low</u> melting temperature** and a **<u>low</u> hot shaping temperature**. Surprisingly, Applicants' glass has a **high** glass transition temperature, T_g, of more than 700 degrees Celsius, and also has both, a **low** melting temperature and a **low** hot shaping temperature. It is submitted that a person skilled in the art would not expect this relationship and would expect the opposite to be true: That is, that a high glass transition temperature, T_g, would result in both, a high melting temperature and a high hot shaping temperature.

A low melting temperature is indicated by a low temperature at a viscosity of 10^2 dPas. The present application discloses a temperature of at most 1350 degrees Celsius at a viscosity of 10^2 dPas, see page 18, line 14-18.

A low hot shaping temperature, also referred to as processing temperature V_A, is indicated by a low temperature at a viscosity of 10^4 dPas. The present application discloses a temperature at a viscosity of 10^4 dPas of at most 1350 degrees Celsius, see page 18, line 14-18.

It is surprising that Applicants' glass has a **high** glass transition temperature and also has both, a **low** melting temperature and a **low**

hot shaping temperature, at a viscosity of 10^4 dPas of at most 1350 degrees Celsius and at a viscosity of 10^2 dPas of at most 1720 degrees Celsius. It is submitted that a person skilled in the art would not expect this relationship and would expect the opposite to be true: That is, that a high glass transition temperature, Tg, of more than 700 degrees Celsius would result in both, a high melting temperature of more than 1350 degrees Celsius at a viscosity of 10^4 dPas and a high hot shaping temperature of more than temperature of more than 1720 degrees Celsius at a viscosity of 10^2 dPas.

It may be added that most of the glasses of the Narita et al. reference, especially those with a relatively high strain point, contain a low percentage of BaO. A low percentage of BaO means that the crystallization stability of the glasses according to Narita et al. reference will not be sufficient to permit use of the glass in various flat glass production processes, such as, float methods and the various drawing methods.

The specific BaO content of from more than 5 % to 8.5 % by weight and the other specific ranges of the other components of the glass permit a sufficient degree of crystallization stability of the glass as claimed in Claim 20. The crystallization stability permits use of the glass in various flat glass production processes, such as, float methods and the various drawing methods.

It is clear from the foregoing that the Narita et al. reference does not make obvious Applicants' claim 20 and thus Applicants' Claim 20 should be allowed.

<u>1f. Discussion Of Dependent Claim 43 Dependent Upon Claim 42</u>

With reference to the Abstract, the cited Narita et al. reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO_2,
5-20 wt% B_2O_3,
6-25 wt%Al_2O_3,
0-10 wt% MgO,
0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,
0-10 wt% ZnO,
0.05-2 wt% SnO_2, and
0.005-2 wt% Cl_2." (emphasis added)

As understood, there is no disclosure in the Narita et al. reference of a glass transition temperature, T_g, for the glass of the Narita et al. reference. Instead, as mentioned above, the Narita et al. reference mentions the strain point, i.e., the temperature at the viscosity of $10^{14.5}$ dPas. The strain point temperature is usually about 25 K lower than the glass transition temperatures, T_g. Perusal of the tables of the Narita et al. reference indicates that the strain point temperature of the glasses of the Narita et al. reference is in the range of from 590 degrees Celsius to 705 degrees Celsius. The temperatures of from 590 degrees Celsius to 705 degrees Celsius, as understood, indicate glass transition temperatures, T_g, for the glasses of the Narita et al. reference of from 565 degrees Celsius to 680 degrees Celsius.

In contrast to the Narita et al. reference, Applicants' Claim 43 states:

"43. ~~The glass according to Claim 42, wherein:~~
said glass has a glass transition temperature, T_g, of > **700°C** to maximize heat resistance of said glass." (emphasis added)

The glass transition temperatures of the glasses of the Narita et al. reference are from 565 degrees Celsius to 680 degrees Celsius

and are thus below the glass transition temperature, T_g, that applies to the glass claimed in Claim 43, that is, a glass transition temperature, T_g, of more than 700 degrees Celsius to maximize heat resistance of the claimed glass.

It is clear from the foregoing that the Narita et al. reference does not make obvious Applicants' claim 43 and thus Applicants' Claim 43 should be allowed.

1g. Discussion Of Dependent Claim 44 Dependent Upon Claim 43

With reference to the Abstract, the cited Narita et al. reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO_2,
5-20 wt% B_2O_3,
6-25 wt% Al_2O_3,
0-10 wt% MgO,
0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,
0-10 wt% ZnO,
0.05-2 wt% SnO_2, and
0.005-2 wt% Cl_2." (emphasis added)

As understood, there only disclosed in the Narita et al. reference, as mentioned above, the strain point, i.e., the temperature at the viscosity of $10^{14.5}$ dPas.

In contrast to the Narita et al. reference, Applicants' Claim 44 states:

"44. The glass according to Claim 43, wherein:
said glass has (i.) and (ii.), wherein (i.) and (ii.) are:
(i.) a processing temperature, V_A, of **≤1350°C at 10^4 dPas**; and
(ii.) a temperature of **≤1720°C at 10^2 dPas**." (emphasis added)

As discussed above, even though the claimed glass has a **high** glass transition temperature, T_g, of more than 700 degrees Celsius, as is claimed in Claim 43, due to the combination of the specific ranges and the specific composition of Applicants' glass, the claimed glass also has both, a **<u>low</u> melting temperature** and a **<u>low</u> hot shaping temperature**. Surprisingly, Applicants' glass has a **high** glass transition temperature, T_g, of more than 700 degrees Celsius, and also has both, a **low** melting temperature and a **low** hot shaping temperature. It is submitted that a person skilled in the art would not expect this relationship and would expect the opposite to be true: That is, that a high glass transition temperature, T_g, would result in both, a high melting temperature and a high hot shaping temperature.

A low melting temperature is indicated by a low temperature at a viscosity of 10^2 dPas. Claim 44 claims a temperature of at most 1350 degrees Celsius at a viscosity of 10^2 dPas.

A low hot shaping temperature, also referred to as processing temperature, V_A, is indicated by a low temperature at a viscosity of 10^4 dPas. Claim 44 claims a temperature at a viscosity of 10^4 dPas of at most 1350 degrees Celsius.

It is surprising that Applicants' glass has a **high** glass transition temperature and also has both, a **low** melting temperature and a **low** hot shaping temperature, at a viscosity of 10^4 dPas of at most 1350 degrees Celsius and at a viscosity of 10^2 dPas of at most 1720 degrees Celsius. It is submitted that a person skilled in the art would not expect this relationship and would expect the opposite to be true: That is, that a high glass transition temperature, T_g, of more than 700 degrees Celsius would result in both, a high melting

temperature of more than 1350 degrees Celsius at a viscosity of 10^4 dPas and a high hot shaping temperature of more than temperature of more than 1720 degrees Celsius at a viscosity of 10^2 dPas.

It is clear from the foregoing that the Narita et al. reference does not make obvious Applicants' claim 44 and thus Applicants' Claim 44 should be allowed.

1h. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence from Claim 20. Claim 20 has been discussed in detail above. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Narita et al. reference, it is submitted that Claims 42-51 are not made obvious, and Claims 42-51 should be allowed.

1i. Discussion Of Rejection Of Examined Claim 17 In View Of Narita et al.

With reference to the Abstract, the cited Narita et al. reference discloses:

"an alkali-free glass consisting of
40-70 wt% SiO_2,
5-20 wt% B_2O_3,
6-25 wt%Al_2O_3,
0-10 wt% MgO,
0-15 wt% CaO,
0-10 wt% SrO,
0-30 wt% BaO,
0-10 wt% ZnO,
0.05-2 wt% SnO_2, and
0.005-2 wt% Cl_2." (emphasis added)

It is again submitted that the Narita et al. reference discloses

substantial ranges for the components of the glass in accordance with the Narita et al. reference. For example, the Abstract of the Narita et al. reference discloses a BaO content that is to be within the wide range of from 0 wt% to 30 wt% of BaO. This is a substantial range of BaO content that does not make obvious Applicants' range of BaO content.

In contrast to the Narita et al. reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal display, a thin film transistor display, and a plasma addressed liquid-crystal display, said substrate comprising:

an alkali-free aluminoborosilicate glass;

said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K;

said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 64.5
B_2O_3	> 6 - 10.5
Al_2O_3	> 18 - 24
MgO	0 - < 3
CaO	1 - < 8
SrO	0.1 - 1.5
BaO	**> 5 - 8**
with SrO + BaO	**< 8.5**
with MgO + CaO + SrO + BaO	**8 - 18**
ZnO	0 - < 2;

said glass being configured to be resistant to thermal shock;

said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and

said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations." (emphasis added)

It is submitted that the presentation made for Claim 20 above,

applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Narita et al. reference and Claims 17 and 34-41 should be allowed.

1j. Discussion Of Dependent Claims 34-41 Dependent Upon Claim 17

It is submitted that the dependent Claims 34-41 are allowable based on their dependence upon Claim 17, having regard to the presentation made for Claim 17. Since the combination of the limitations of Claim 17 is not shown or disclosed in the Narita et al. reference, it is submitted that Claims 34-41, dependent upon Claim 17, are not made obvious, and Claims 34-41 should be allowed.

2. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of Peuchert et al.

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peuchert at al. (US 6,417,124).

2a. Rejection Of Examined Claim 20 In View of Peuchert et al.

The Examiner stated:

> "Claims 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peuchert et al., U.S. 6,417,124.
>
> Peuchert et al. teach an alkali-free aluminoborosilicate comprising 50-70 wt% SiO_2, 0.5-15 wt% B_2O_3, 10-25 wt%Al_2O_3, 0-10 wt% MgO, 0-10 wt% CaO, 0-12 wt% SrO, 0-15 wt% BaO, 0-10 wt% ZnO, 0-5 wt% ZrO_2, 0-5 wt% TiO_2, 0-2 SnO_2, and 0.05-2 MoO_3. See abstract of Peuchert et al. The reference teaches that the glass can be used as a substrate for thin film transistors, active matrix liquid crystal displays, and plasma addressed liquid crystals. See column 1, lines 6-11. The reference teaches that glasses for the above applications have high thermal shock resistance, high transparency over a broad

spectral range (UV and VIS), and a density equal to or lower than 2.6 g/cm^3. See column 1, lines 11-16. The reference teaches that the glasses can be produced by the float glass method, which produces streak-free substrates with low surface undulations. See column 1, lines 25-30. The reference teaches that the glasses are free from As_2O_3 and Sb_2O_3. See column 5, lines 41-49. The reference teaches that the T_g is greater than 650 °C. See column 7, line 46. The reference further teaches that the thermal expansion coefficient is from $2.8x10^{-6}$/K to $5.0x10^{-6}$/K. See column 8, lines 43-44.

Peuchert et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Peuchert et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Peuchert et a1. because overlapping ranges have been held to establish prima facie obviousness."

2b. Discussion Of Rejection Of Examined Claim 20 In View Of Peuchert et al.

With reference to the Abstract, the cited Peuchert et al. reference discloses:

"an alkali-free aluminoborosilicate comprising

50-70 wt% SiO_2,
0.5-15 wt% B_2O_3,
10-25 wt% Al_2O_3,
0-10 wt% MgO,
0-10 wt% CaO,
0-12 wt% SrO,
0-15 wt% BaO,
0-10 wt% ZnO,
0-5 wt% ZrO_2,
0-5 wt% TiO_2,
0-2 SnO_2, and

0.05-2 MoO_3."

It is submitted that the Peuchert et al. reference discloses very large ranges for eight of the components of the aluminoborosilicate glass, namely, 50-70 wt% for SiO_2, 0.5-15 wt% B_2O_3, for 10-25 wt% Al_2O_3, 0-10 wt% for MgO, 0-10 wt% for CaO, 0-12 wt% for SrO, 0-15 wt% for BaO, 0-10 wt% ZnO.

It is submitted that the very large ranges for the mentioned eight glass components of the Peuchert et al. reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K;
said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 65
B_2O_3	> 6 - 10.5
Al_2O_3	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	≤ 8.6
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2."

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The ranges of the present invention include only a very small portion of the ranges of the Peuchert et al. reference. Therefore, the Peuchert et al. reference is a non-teaching reference. The specific characteristics of the present

invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Peuchert et al. reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Peuchert et al. reference.

In the following, the distinctions between the glass of the Peuchert et al. reference and the glass of Applicants' Claim 20 are summarized in Table 2 on the following page. It is submitted that the detailed analysis presented with respect to Claim 20 in connection with the Narita et al. reference applies in corresponding manner in the presentation in connection with the Peuchert et al. reference.

Table 2 - Comparison Of Glass Of Peuchert et al. And Glass Of Applicants' Claim 20

Component or Sum of Components	**Peuchert's Ranges of Components**	**Overlap between Applicants' Ranges of Components and Peuchert's Ranges of Components**	**Ratio of Applicants' Ranges of Components to Peuchert's Ranges of Components**	**Running Probability**
SiO_2	20%	7%	0.35	
B_2O_3	14.5%	4.5%	0.31	1 in 9
Al_2O_3	15%	11%	0.73	1 in 12
MgO	10%	3%	0.30	1 in 42
CaO	12%	9%	0.75	1 in 56
SrO	12%	1.4%	0.116	1 in 483
BaO	15%	3.5%	0.23	1 in 2,103
ZnO	10%	2%	0.20	1 in 10,515
SrO + BaO	26%	3.5%	0.135	1 in 78,127
MgO + CaO + SrO + BaO	18%	10%	0.555	1 in 140,770

Multiplication of all the ratios of Applicants' range of components vs. Peuchert's range of components reveals a result of 0.0000071 which corresponds to 0.00071%.

The low percentage of 0.00071 is an extremely small percentage of the total range of possibilities as suggested in the Peuchert et al. reference. The reciprocal of 0.0000071 is 140,770. In other words, there are over 140,770 other ranges covered by the Peuchert et al. reference of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 140,770 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $^{1}/_{140770}$ probability of the ranges that are covered by the Peuchert et al. reference.

Thus, it is not understood how the Peuchert et al. reference can make Applicants' ranges obvious. It is submitted that the Peuchert et al. reference is not applicable as a reference because of the minuscule factor of 0.071×10^{-4}.

It is submitted that the foregoing differences of Applicants' glass are sufficient to show the patentable distinction over the Peuchert et al. reference.

Furthermore, there is no disclosure in the Peuchert et al. reference of the sum of SrO plus BaO being at most 8.6%. There is also no disclosure in the Peuchert et al. reference of the sum of MgO plus CaO plus SrO plus BaO being in the range of from 8 % to 18 %. The importance of a specific BaO content in Applicants' glass has been discussed in Section 1d., above.

It is clear from the foregoing that the Peuchert et al. reference does not make obvious Applicants' Claim 20 and thus Applicants'

Claim 20 should be allowed.

2c. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Peuchert et al. reference, it is submitted that Claims 42-51, dependent upon Claim 20, are not made obvious, and Claims 42-51 should be allowed.

2d. Rejection of Examined Claim 17 And Claims 34-41 In View of Peuchert et al.

With reference to the Abstract, the cited Peuchert et al. reference discloses:

> "an alkali-free aluminoborosilicate comprising
>
> 50-70 wt% SiO_2,
> 0.5-15 wt% B_2O_3,
> 10-25 wt% Al_2O_3,
> 0-10 wt% MgO,
> 0-10 wt% CaO,
> 0-12 wt% SrO,
> 0-15 wt% BaO,
> 0-10 wt% ZnO,
> 0-5 wt% ZrO_2,
> 0-5 wt% TiO_2,
> 0-2 SnO_2, and
> 0.05-2 MoO_3."

It is submitted that the Peuchert et al. reference discloses very large ranges for eight of the components of the aluminoborosilicate glass, namely, .50-70 wt% for SiO_2, 0.5-15 wt% B_2O_3, for 10-25 wt% Al_2O_3, 0-10 wt% for MgO, 0-10 wt% for CaO, 0-12 wt% for SrO, 0-15 wt% for BaO, 0-10 wt% ZnO.

It is submitted that the very large ranges for the mentioned eight glass components of the Peuchert et al. reference cover a great number of different types of borosilicate glass.

In contrast to the Peuchert et al. reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal display, a thin film transistor display, and a plasma addressed liquid-crystal display, said substrate comprising:

an alkali-free aluminoborosilicate glass;

said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K;

said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 64.5	
B_2O_3	> 6 - 10.5	
Al_2O_3	> 18 - 24	
MgO	0 - < 3	
CaO	1 - < 8	
SrO	0.1 - 1.5	
BaO	> 5 - 8	
with SrO + BaO	< 8.5	
with MgO + CaO + SrO + BaO		8 - 18
ZnO	0 - < 2;	

said glass being configured to be resistant to thermal shock;

said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and

said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations."

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Peuchert et al.

reference and Claims 17 and 34-41 should be allowed.

3. Rejection Of Claims 17-29 Under 35 U.S.C. §103 In View Of Watzke

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Watzke (German DOS 196 01 922 A1).

3a. Rejection Of Examined Claim 20 In View Of Watzke

The Examiner stated:

"Claims 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watzke, German Patent DE 19601922 A1.

Watzke teaches an alkaline earth aluminoborosilicate glass consisting of 50-65 wt% SiO_2, 5-15 wt% B_2O_3, 10-20 wt% Al_2O_3, 0-10 wt% MgO, 0-20 wt% CaO, 0-20 wt% SrO, 0-20 wt% BaO, 0-10 wt% ZnO, 0.01-1 wt% SnO, 0.1-2 wt% ZrO_2, 0-10 La_2O_3, 0-10 wt% Nb_2O_5, 0-10 wt% Ta_2O_5 and 0-10 wt% TiO_2. See the Derwent Abstract of Watzke.

More specifically, Watzke teaches the compositional ranges are 53-63 wt% SiO_2, 5-15 wt% B_2O_3, 12-20 Al_2O_3, 0-5 wt% MgO, 2-10 wt% CaO, 0-10 wt% SrO, 3-15 wt% BaO, 0.01-1 wt% SnO, and 0.1-1 wt% ZrO_2. See page 3, lines 37-38 of DE 19,601,922. Watzke teaches that glass can be used as a substrate for display technologies or as thin layer solar cells. See the Derwent Abstract, use paragraph.

Watzke differs from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Watzke overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Watzke because overlapping ranges have been held to establish prima facie obviousness.

One of ordinary skill in the art would expect that glasses with overlapping compositional ranges would have overlapping

ranges of properties as recited in claims 17-21, 28, and 29.

<u>3b. Discussion Of Rejection Of Examined Claim 20 In View Of Watzke</u>

With reference to the DERWENT Abstract, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of

50-65 wt% SiO_2,
5-15 wt% B_2O_3,
10-20 wt% Al_2O_3,
0-10 wt% MgO,
0-20 wt% CaO,
0-20 wt% SrO,
0-20 wt% BaO,
0-10 wt% ZnO,
0.01-1 wt% SnO,
0.1-2 wt% ZrO_2,
0-10 La_2O_3,
0-10 wt% Nb_2O_5,
0-10 wt% Ta_2O_5 and
0-10 wt% TiO_2.

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-10 wt% for MgO, 0-20 wt% for CaO, 0-20 wt% for SrO, and 0-20 wt% for BaO.

It is submitted that at least the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

With reference to the example on page 3, lines 37-38, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of

53-63 wt% SiO_2,
5-15 wt% B_2O_3,
12-20 wt% Al_2O_3,

0-5 wt% MgO,
2-10 wt% CaO,
0-10 wt% SrO, and
3-15 wt% BaO.

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-5 wt% for MgO, 2-10 wt% for CaO, 0-10 wt% for SrO, and 3-15 wt% for BaO.

It is submitted that at least the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8 x 10^{-6}/K and 3.8 x 10^{-6}/K;
said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 65
B_2O_3	> 6 - 10.5
Al_2O_3	> 14 - 25
MgO	0 - < 3
CaO	0 - 9
SrO	0.1 - 1.5
BaO	> 5 - 8.5
with SrO + BaO	**≤ 8.6**
with MgO + CaO + SrO + BaO	**8 - 18**
ZnO	0 - < 2."

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific

components of the claimed glass. The ranges of the present invention include only a very small portion of the ranges of the Watzke reference. Therefore, the Watzke reference is a non-teaching reference. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Watzke reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Watzke reference.

In the following, the distinctions between the glass of the Watzke according to the DERWENT Abstract and the example on page 3, lines 37-38 of Watzke, and the glass of Applicants' Claim 20 are summarized in Tables 3 and 4. It is submitted that the detailed analysis presented with respect to Claim 20 in connection with the Narita et al. reference applies in corresponding manner for the presentation in connection with the Watzke reference.

Please note that Watzke presents some ranges that overlap with the ranges of Claim 20. For example, in the abstract of Watzke the Al_2O_3 content is 10-20%, and in the page 3 example of Watzke the Al_2O_3 content is 12-20%. In Claim 20, the Al_2O_3 is 14-25%. The overlap between the Al_2O_3 range of Watzke, either in the abstract or on page 3, and the Al_2O_3 range of Claim 20 is therefore 14-20%, for a range of 6%. This formula was used to calculate the results shown in the subsequent Tables 3 and 4.

Table 3 - Comparison Of Glass Of Watzke (Ranges in Abstract) And Glass Of Applicants' Claim 20

Component or Sum of Components	Watzke's Ranges of Components	Overlap between Applicants' Ranges of Components and Watzke's Ranges of Components	Ratio of Applicants' Ranges of Components to Watzke's Ranges of Components	Running Probability
SiO_2	15%	7%	0.466	
B_2O_3	10%	4.5%	0.45	1 in 5
Al_2O_3	10%	6%	0.60	1 in 8
MgO	10%	3%	0.30	1 in 26
CaO	20%	9%	0.45	1 in 59
SrO	20%	1.4%	0.07	1 in 841
BaO	20%	3.5%	0.175	1 in 4,806
ZnO	10%	2%	0.20	1 in 24,030
SrO + BaO	40%	3.5%	0.0875	1 in 274,626
MgO + CaO + SrO + BaO	70%	10%	0.143	1 in 1,920,465

Table 4 - Comparison Of Glass Of Watzke (Ranges on Page 3, lines 37-38) And Glass Of Applicants' Claims 20 and 42

Component or Sum of Components	Narita's Ranges of Components	Overlap between Applicants' Ranges of Components and Narita's Ranges of Components	Ratio of Applicants' Ranges of Components to Narita's Ranges of Components	Running Probability
SiO_2	10%	5%	0.5	
B_2O_3	10%	4.5%	0.45	1 in 4
Al_2O_3	8%	6%	0.75	1 in 6
MgO	5%	3%	0.6	1 in 10
CaO	8%	7%	0.875	1 in 11
SrO	10%	1.4%	0.14	1 in 81
BaO	12%	3.5%	0.292	1 in 276
SrO + BaO	22%	5.6%	0.255	1 in 1,083
MgO + CaO + SrO + BaO	35%	10%	0.286	1 in 3,786
ZnO (Claim 42 only)	10%	1.9%	0.19	1 in 19,926

Multiplication of all the ratios of Applicants' range of components vs. Watzke's Abstract range of components reveals a result of 0.0000005207 which corresponds to 0.00005207%.

The low percentage of 0.00005207 is an extremely small percentage of the total range of possibilities as suggested in the Watzke Abstract. The reciprocal of 0.0000005207 is 497,898. In other words, there are over 497,898 other ranges covered by the Watzke Abstract of the same scope as the ranges of the present invention. It would be virtually impossible for someone to be able to determine which of the 497,898 ranges would be advantageous to cover so as to provide the invention of the present application. Still in other words, Applicants' claim covers only a $^{1}/_{497898}$ probability of the ranges that are covered by the Watzke Abstract.

Thus, it is not understood how the Watzke reference can make Applicants' ranges obvious. It is submitted that the Watzke reference is not applicable as a reference because of the minuscule factor of $0.00005207 \times 10^{-4}$.

Multiplication of all the ratios of Applicants' range of components vs. Watzke's range of components on page 3, lines 37-38, reveals a result of 0.000264 which corresponds to 0.0264%.

The low percentage of 0.0264 is a small percentage of the total range of possibilities as suggested in page 3, lines 37-38, of Watzke.

Thus, it is not understood how the Watzke reference can make Applicants' ranges obvious.

In addition, Claim 42, which depends directly from Claim 20, sets forth a minimum amount of ZnO of at least 0.1 wt%, thus defining a range for ZnO of at least 0.1% to less than 2%. In the example on page 3, lines 37-38, of Watzke, ZnO is not listed as one

of the components, and thus it is believed that Claim 42 distinguishes over this example. However, Watzke does disclose ZnO in the range of 0-10% in the abstract. Assuming some amount of ZnO in the range of 0-10% could be added to the example on page 3, lines 37-38, it is respectfully submitted that the probability of someone determining the range of ZnO, as set forth in Claim 42, in addition to all of the other component ranges as discussed above, is 1 in 19,926 (see Table 4), which again would appear to be highly unlikely to virtually impossible.

Furthermore, there is no disclosure in the Watzke reference of the sum of SrO plus BaO being at most 8.6%. There is also no disclosure in the Watzke reference of the sum of MgO plus CaO plus SrO plus BaO being in the range of from 8 % to 18 %. The importance of a specific BaO content in Applicants' glass has been discussed in Section 1d., above.

It is clear from the foregoing that the Watzke reference does not make obvious Applicants' Claim 20 and thus Applicants' Claim 20 should be allowed.

3c. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Watzke reference, it is submitted that Claims 42-51, dependent upon Claim 20, are not made obvious, and Claims 42-51 should be allowed.

3d. Rejection Of Examined Claim 17 And Claims 34-41 In View Of Watzke

With reference to the DERWENT Abstract, Watzke discloses:

"alkaline earth aluminoborosilicate glass consisting of
50-65 wt% SiO_2,
5-15 wt% B_2O_3,
10-20 wt% Al_2O_3,
0-10 wt% MgO,
0-20 wt% CaO,
0-20 wt% SrO,
0-20 wt% BaO,
0-10 wt% ZnO,
0.01-1 wt% SnO,
0.1-2 wt% ZrO_2,
0-10 La_2O_3,
0-10 wt% Nb_2O_5,
0-10 wt% Ta_2O_5 and
0-10 wt% TiO_2.

It is submitted that the Watzke reference discloses very large ranges for at least four of the components of the aluminoborosilicate glass, namely, 0-10 wt% for MgO, 0-20 wt% for CaO, 0-20 wt% for SrO, and 0-20 wt% for BaO.

It is submitted that at least the large ranges for the mentioned four glass components of the Watzke reference cover a great number of different types of borosilicate glass.

In contrast to the Watzke reference, Claim 17 states:

"17. A glass substrate for a flat panel liquid-crystal display, such as for a laptop computer, the flat panel liquid-crystal display including a twisted nematic display, a supertwisted nematic display, an active matrix liquid-crystal

display, a thin film transistor display, and a plasma addressed liquid-crystal display, said substrate comprising:

an alkali-free aluminoborosilicate glass;

said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8×10^{-6}/K and 3.8×10^{-6}/K;

said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 64.5
B_2O_3	> 6 - 10.5
Al_2O_3	> 18 - 24
MgO	0 - < 3
CaO	1 - < 8
SrO	0.1 - 1.5
BaO	> 5 - 8
with SrO + BaO	< 8.5
with MgO + CaO + SrO + BaO	8 - 18
ZnO	0 - < 2;

said glass being configured to be resistant to thermal shock;

said glass being configured to have a high transparency over a broad spectral range in the visible and ultra violet ranges; and

said glass being configured to be free of bubbles, knots, inclusions, streaks, and surface undulations."

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Watzke reference and Claims 17 and 34-41 should be allowed.

4. Rejection Of Claims 17-29 Under 35 U.S.C. § 103 In View Of Lautenschläger et al.

Claims 17-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lautenschläger et al. (US 6,465,381).

4a. Rejection Of Examined Claim 20 In View Of Lautenschläger

et al.

The Examiner stated:

"Lautenschläger et al. teach an alkali-free glass consisting of >60-65 wt% SiO_2, 6.5-9.5 wt% B_2O_3, 14-21 wt% Al_2O_3, 1-8 wt% MgO, 1-6 wt% CaO, 1-9 wt% SrO, 0.1-3.5 wt% BaO, 0.1-1.5 wt% ZrO_2, 0.1-1 wt% SnO_2, 0.1-1 TiO_2 and 0.001-1 wt% CeO_2. See abstract of Lautenschläger et al. Lautenschläger et al. teach that glass can be used as a substrate for display technologies. See Abstract of Lautenschläger et al. The reference teaches that the glasses used for display technologies have the following properties: coefficient of thermal expansion from 3.0 to $3.8x10^{-6}/K$, T_g from 710-780 °C, a density less than or equal to 2.5 g/cm^3, and free from visual defects such as inclusions, knots, and bubbles. See column 1, lines 35-67. Lautenschläger et al. teach that the glass can be produced with the above mentioned properties by the float glass or draw methods. See column 4, lines 41-52. The reference further teaches that As_2O_3 and Sb_2O_3 should not be contained in glasses produced in the float method but may be used in nonreducing conditions such as downdraw method. See column 7, lines 25-36.

Lautenschläger et al. differ from the instant claims by not teaching specific examples that lie within the compositional ranges nor ranges of glass components which are sufficiently specific to anticipate the claim limitations. However, the compositional ranges of Lautenschläger et al. overlap the compositional ranges of claims 17-29. Overlapping ranges have been held to establish prima facie obviousness. See MPEP 2144.05.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges of Lautenschläger et al. because overlapping ranges have been held to establish prima facie obviousness."

4b. Discussion Of Rejection Of Examined Claim 20 In View Of Lautenschläger et al.

With reference to the Abstract, Lautenschläger et al. discloses:

"alkali-free glass consisting of
>60-65 wt% SiO_2,
6.5-9.5 wt% B_2O_3,
14-21 wt% Al_2O_3,
1-8 wt% MgO,
1-6 wt% CaO,
1-9 wt% SrO,
0.1-3.5 wt% BaO,
0.1-1.5 wt% ZrO_2,
0.1-1 wt% SnO_2,
0.1-1 TiO_2 and
0.001-1 wt% CeO_2." (emphasis added)

In the abstract of Lautenschläger, the BaO content is listed in the range of 0.1 - 3.5 wt%. Lautenschläger does not show the BaO content higher than 3.5 wt%.

It is also submitted that Lautenschläger et al. only refers to glasses that contain ZrO_2, SnO_2, TiO_2, and CeO_2. The glasses have to contain all four alkaline earth metal oxides which is not a requirement in the claimed invention.

With respect to the SrO content of Lautenschläger et al., all examples show ≥ 4 wt-%, which is too high for the important melting and hot forming properties, as discussed in detail above.

In contrast, Applicants' Claim 20 states:

"A glass comprising:
a substantially alkali-free aluminoborosilicate glass;
said glass having a coefficient of thermal expansion $\alpha_{20/300}$ of between 2.8×10^{-6}/K and 3.8×10^{-6}/K;
said glass having the composition (in % by weight, based on oxide):

SiO_2	> 58 - 65
B_2O_3	> 6 - 10.5
Al_2O_3	> 14 - 25
MgO	0 - < 3

CaO	0 - 9
SrO	0.1 - 1.5
BaO	**> 5 - 8.5**
with SrO + BaO	**≤ 8.6**
with MgO + CaO + SrO + BaO	**8 - 18**
ZnO	0 - < 2."

It is respectfully submitted that, in contrast to Lautenschläger, the BaO content is listed in the range of greater than 5 to 8.5 wt% in Claim 20. Lautenschläger does not show the BaO content higher than 3.5 wt%.

It is submitted that Applicants' Claim 20 claims a **selection invention** of a selection of specific ranges for the specific components of the claimed glass. The specific characteristics of the present invention result only by selecting the very specific ranges of the specific components. Since there is nothing in the Lautenschläger et al. reference that would point to the specific ranges of the specific components of the present invention, it is further submitted that Applicants' selection invention is not obvious over the Lautenschläger et al. reference.

It is clear from the foregoing that the Lautenschläger et al. reference does not make obvious Applicants' Claim 20 and thus Applicants' Claim 20 should be allowed.

4c. Discussion Of Dependent Claims 42-51 Dependent Upon Claim 20

It is submitted that the dependent Claims 42-51 are allowable based on their dependence upon Claim 20, having regard to the presentation made for Claim 20. Since the combination of the limitations of Claim 20 is not shown or disclosed in the Lautenschläger et al. reference, it is submitted that Claims 42-51,

dependent upon Claim 20, are not made obvious by Lautenschläger et al., and Claims 42-51 should be allowed.

4d. Rejection Of Examined Claim 17 And Claims 34-41 In View Of Lautenschläger et al.

It is submitted that the presentation made for Claim 20 above, applies correspondingly to Claim 17 because Claim 17 claims narrower ranges of the glass components than Claim 20.

Therefore, it is submitted that Claim 17 and the Claims 34-41 dependent therefrom are not obvious over the Lautenschläger et al. reference and Claims 17 and 34-41 should be allowed.

Art Made of Record

The prior art made of record and not applied has been carefully reviewed, and it is submitted that it does not, either taken singly or in any reasonable combination with the other prior art of record, defeat the patentability of the present invention or render the present invention obvious. Further, Applicants are in agreement with the Examiner that the prior art made of record and not applied does not appear to be material to the patentability of the claims currently pending in this application.

In view of the above, it is respectfully submitted that this application is in condition for allowance, and early action towards that end is respectfully requested.

Leave to Delay Treatment of Formal Objections Until Allowable Subject Matter is Indicated:

In accordance with 37 C.F.R. §1.111, it is hereby respectfully requested that any objections or requirements not fully treated and set forth in the outstanding Office action that relate to form and are not necessary to further consideration of the now pending claims, be held

in abeyance until allowable subject matter is indicated.

Summary and Conclusion:

It is submitted that Applicants have provided a new and unique FLAT PANEL LIQUID-CRYSTAL DISPLAY SUCH AS FOR A LAPTOP COMPUTER. It is submitted that the claims, as amended, are fully distinguishable from the prior art. Therefore, it is requested that a Notice of Allowance be issued at an early date.

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Respectfully submitted,

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